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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/009,167	06/05/2002	Ron Naaman	NAAMAN=2	8340

1444 7590 12/30/2005

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EXAMINER	
BABIC, CHRISTOPHER M	
ART UNIT	**PAPER NUMBER**
1637	

DATE MAILED: 12/30/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	Application No. 10/009,167	Applicant(s) NAAMAN ET AL.
	Examiner Christopher M. Babic	Art Unit 1637

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *25 October 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1 and 5-19* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1 and 5-19* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *07 December 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Status of the Claims

Claims 1 and 5-16 are pending. The following Office Action is in response to Applicant's response dated October 25, 2005. Any rejection set forth in the NON-FINAL Office Action dated July 25, 2005 not reasserted in the following Office Action is considered withdrawn.

Response to Arguments - 35 USC § 103

Applicant's arguments with regard to the Hashimoto et al. reference have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of newly discovered applicable prior art.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein

were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

1. Claims 1, 5-11, and 17-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cahen et al. (WO 98/19151) in view of Harvey et al. (U.S. 5,945,832).

Regarding Claim 1, Cahen et al. discloses a hybrid organic-semiconductor device characterized by being composed of: (i) at least one layer of a conducting semiconductor; (ii) at least one insulating layer; (iii) a multifunctional organic sensing molecule directly chemisorbed on one of its surfaces, said multifunctional organic sensing molecule having at least one functional group that binds to said surface and at least one other functional group that serves as a sensor; and (iv) two conducting pads on the top layer making electrical contact with the electrically conducting layer (1), such that electrical current can flow between them at a finite distance from the surface of the device (Abstract; Page 4, Lines 3-13; Figures 1, 2). In addition, Cahen et al. disclose a semiconductor device wherein: said conducting semiconductor layer is on top of one of said insulating or semi-insulating layers, said two conducting pads are on both sides on top of an upper layer which is either said conducting semiconductor layer or another of

said insulating or semi-insulating layers, making electrical contact with said conducting semiconductor layer (Fig 2A, 2B). Cahen et al. does not disclose a layer of single-stranded DNA or RNA directly adsorbed to an upper layer which is either said conducting semiconductor layer or another of said insulating or semi-insulating layers wherein exposure of said single-stranded DNA probe to a sample containing a target DNA or RNA, under hybridization conditions, causes either a current change resulting from the hybridization process when a constant electric potential is applied between the two conducting pads or a change in the electric potential required to keep a constant current.

Harvey et al. disclose a semi-conductor device (Figures 1-3, for example) used in a method for the measurement of electrical characteristics of organic molecules (Column 2, Lines 1-10; Column 3, Lines 10-40, for example). They further disclose layers of single-stranded DNA (Column 3, Lines 10-15, for example) bridging the gap between electrical contacts (Figures 1-3, for example). Moreover, they specifically disclose that hybridization can be detected by a change in the electrical characteristics brought on by duplex formation (Column 3, Lines 35-40).

Based on the combined disclosures of the applied references, one of ordinary skill in the art at the time of invention would have had a reasonable expectation of success directly adsorbing a layer of single-stranded DNA or RNA to the semi-conductor device of Cahen et al. wherein exposure of said single-stranded DNA probe to a sample containing a target DNA or RNA, under hybridization conditions, causes either a current change resulting from the hybridization process when a constant electric

potential is applied between the two conducting pads or a change in the electric potential required to keep a constant current. The motivation to do so, provided by Harvey et al. would have been to detect DNA hybridization. At the time of invention, the disclosure of Harvey et al. clearly would have provided the instruction necessary for one of ordinary skill in the art to practice the methods as claimed. It would have been *prima facie* obvious to one of ordinary skill in the art at the time of invention to practice the instant methods as claimed.

Regarding Claim 5, Cahen disclose a semiconductor device, wherein the semiconductor material is selected from a III-V and a II-VI material, or mixture thereof, wherein III, V, II, and VI denote the Periodic Table elements III=Ga, In; V=As, P; II=Cd, Zn; VI=S, Se, Te (Page 5, Lines 9-12).

Regarding Claim 6, Cahen et al. disclose a semiconductor device, wherein the semiconductor material is doped n-GaAs or n-(Al,Ga)As (Page 5, Lines 12-15).

Regarding Claim 7, Cahen et al. disclose a semiconductor device, wherein a dielectric insulating material is selected from a III-V and a II-IV material, or mixtures thereof, wherein III, V, II, and VI denote the Periodic Table elements III=Ga, In; V=As, P; II=Cd, Zn; VI=S, Se, Te (Page 7, Lines 12-16).

Regarding Claim 8, Cahen et al. disclose a semiconductor device, wherein the undoped semiconductor is undoped GaAs (Page 7, Line 16).

Regarding Claim 9, Cahen et al. disclose a semiconductor device, wherein said conducting semiconductor layer is a layer of doped n-GaAs which is on top of a semi-insulating layer of (Al,Ga)As which is on top of another semi- insulating layer of GaAs

(Page 8, Lines 12-30; Page 9, Lines 1-14; Fig 2A, 2B). They disclose a thin layer of a multifunctional organic sensing molecule adsorbed on the undoped GaAs surface (Page 9, Lines 11-12; Fig 2A,2B). Cahen does not disclose a layer of at least one single-stranded DNA probe.

Harvey et al. disclose immobilization of single-stranded nucleic acid probes to a base plate of a semi-conductor element (Figures 1-3; Column 2, Lines 45-50, for example).

Regarding Claim 10, Cahen et al. disclose a semiconductor device, wherein said conducting semiconductor layer is a layer of doped n-(A1,Ga)As which is on top of an insulating layer of undoped GaAs which is on top of a semi- insulating layer of GaAs, on top of said conducting semiconductor doped n-(A1,Ga)As layer there is a semi-insulating undoped (Al,Ga)As layer on top of which there is an upper undoped GaAs semi-insulating layer (Page 8, Lines 12-30; Page 9, Lines 1-14; Fig 2A, 2B). They disclose a thin layer of a multifunctional organic sensing molecule adsorbed on the undoped GaAs surface (Page 9, Lines 11-12; Fig 2A,2B). Cahen does not disclose a layer of at least one single-stranded DNA probes.

Harvey et al. disclose immobilization of single-stranded nucleic acid probes to a base plate of a semi-conductor element (Figures 1-3; Column 2, Lines 45-50, for example).

Regarding Claim 11, the semiconductor device disclosed by Cahen has been outlined in the previous paragraphs. Cahen does not disclose wherein said single-

stranded DNA probes comprise a sequence complementary to a sequence of a target DNA or RNA.

Harvey et al. disclose nucleic acid probes that have a base sequence complementary to the entire or part of a target base sequence (Column 3, Lines 35-40).

Regarding Claim 17, the semiconductor device disclosed by Cahen has been outlined in the previous paragraphs. Cahen does not disclose a method for the detection of a target DNA or RNA which comprises: exposing the single-stranded DNA probe of at least one semiconductor device to a sample containing the target DNA or RNA, under hybridization conditions; and monitoring either the current change resulting from the hybridization process when a constant electric potential is applied between the two conducting pads or measuring the change in the electric potential required to keep a constant current.

Harvey et al. disclose layers of single-stranded DNA (Column 3, Lines 10-15, for example) bridging the gap between electrical contacts (Figures 1-3, for example). Moreover, they specifically disclose that hybridization can be detected by a change in the electrical characteristics brought on by duplex formation (Column 3, Lines 35-40).

Regarding Claims 18 and 19, the methods for DNA or RNA detection and semiconductor device disclosed by Cahen has been outlined in the previous paragraphs. Cahen does not disclose wherein said single-stranded DNA probes comprise a sequence complementary to a sequence of a target DNA or RNA.

Harvey et al. disclose nucleic acid probes that have a base sequence complementary to the entire or part of a target base sequence (Column 3, Lines 35-40).

2. Claims 12-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cahen et al. (WO 98/19151) in view of Harvey et al. (U.S. 5,945,832), in further view of Chee et al. (U.S. 5,837,832).

Regarding Claims 12-16, the disclosures of Cahen et al. and Harvey et al. have been outlined in the above rejections. Neither of the applied references specifically disclose wherein multiple single-stranded DNA probes comprise a sequence complementary to a mutation sequence of a gene responsible for a genetic disease or disorder.

Chee et al. disclose DNA chips for detecting mutations (Figure 2; Column 2, Lines 40-65; Columns 7-13, for example) comprising multiple single-stranded DNA probes comprise a sequence complementary to a mutation sequence of a gene responsible for a genetic disease or disorder (Figure 2; Column 2, Lines 40-65; Columns 7-13, for example). They further disclose several advantages of the probe arrays including the highly informative nature of each position on the array (Column 14, Lines 1-15, for example).

Based on the combined disclosures of the applied references, one of ordinary skill in the art at the time of invention would have had a reasonable expectation of success practicing DNA hybridization detection techniques of Cahen et al. and Harvey et al. further comprising multiple single-stranded DNA probe arrays comprising a sequence complementary to a mutation sequence of a gene responsible for a genetic

disease or disorder. The motivation to do so, provided by Chee et al., would have been to determine genetic information of a disease using the highly informative nature of each position on the mutation detection probe arrays. At the time of invention, the disclosure of Chee et al. clearly would have provided the instruction necessary for one of ordinary skill in the art to practice the methods as claimed. It would have been *prima facie* obvious to one of ordinary skill in the art at the time of invention to practice the instant methods as claimed.

3. Claims 1 and 5-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cahen et al. (WO 98/19151) in view of Connolly (U.S. 2002/0022223).

Regarding Claim 1, Cahen et al. discloses a hybrid organic-semiconductor device characterized by being composed of: (i) at least one layer of a conducting semiconductor; (ii) at least one insulating layer; (iii) a multifunctional organic sensing molecule directly chemisorbed on one of its surfaces, said multifunctional organic sensing molecule having at least one functional group that binds to said surface and at least one other functional group that serves as a sensor; and (iv) two conducting pads on the top layer making electrical contact with the electrically conducting layer (1), such that electrical current can flow between them at a finite distance from the surface of the device (Abstract; Page 4, Lines 3-13; Figures 1, 2). In addition, Cahen et al. disclose a semiconductor device wherein: said conducting semiconductor layer is on top of one of

said insulating or semi-insulating layers, said two conducting pads are on both sides on top of an upper layer which is either said conducting semiconductor layer or another of said insulating or semi-insulating layers, making electrical contact with said conducting semiconductor layer (Fig 2A, 2B). Cahen et al. does not disclose a layer of single-stranded DNA or RNA directly adsorbed to an upper layer which is either said conducting semiconductor layer or another of said insulating or semi-insulating layers wherein exposure of said single-stranded DNA probe to a sample containing a target DNA or RNA, under hybridization conditions, causes either a current change resulting from the hybridization process when a constant electric potential is applied between the two conducting pads or a change in the electric potential required to keep a constant current.

Connolly discloses a semi-conductor device (Figures 1-2; Page 1, [0008], for example) used in a method for testing for the presence of a target nucleic acid molecule (Page 2, [0019]; Page 7, [0059], [0066]; Page 8, [0085]-[0089], for example). Connolly further discloses layers of single-stranded DNA (Figures 1-2; Page 2, [0019], for example). Moreover, Connolly specifically discloses that a current between the two leads is indicative of the presence of the target nucleic acid (Page 9, [0088], for example). Connolly further discloses that the invention has the advantage of being used for multiple samples (Page 6, [0057], for example).

Based on the combined disclosures of the applied references, one of ordinary skill in the art at the time of invention would have had a reasonable expectation of success directly adsorbing a layer of single-stranded DNA or RNA to the semi-

conductor device of Cahen et al. wherein exposure of said single-stranded DNA probe to a sample containing a target DNA or RNA, under hybridization conditions, causes either a current change resulting from the hybridization process when a constant electric potential is applied between the two conducting pads or a change in the electric potential required to keep a constant current. The motivation to do so, provided by Connolly would have been to detect DNA hybridization with the added advantage of using the device for the detection of multiple samples. At the time of invention, the disclosure of Connolly clearly would have provided the instruction necessary for one of ordinary skill in the art to practice the methods as claimed. It would have been *prima facie* obvious to one of ordinary skill in the art at the time of invention to practice the instant methods as claimed.

Regarding Claim 5, Cahen disclose a semiconductor device, wherein the semiconductor material is selected from a III-V and a II-VI material, or mixture thereof, wherein III, V, II, and VI denote the Periodic Table elements III=Ga, In; V=As, P; II=Cd, Zn; VI=S, Se, Te (Page 5, Lines 9-12).

Regarding Claim 6, Cahen et al. disclose a semiconductor device, wherein the semiconductor material is doped n-GaAs or n-(Al,Ga)As (Page 5, Lines 12-15).

Regarding Claim 7, Cahen et al. disclose a semiconductor device, wherein a dielectric insulating material is selected from a III-V and a II-IV material, or mixtures thereof, wherein III, V, II, and VI denote the Periodic Table elements III=Ga, In; V=As, P; II=Cd, Zn; VI=S, Se, Te (Page 7, Lines 12-16).

Regarding Claim 8, Cahen et al. disclose a semiconductor device, wherein the undoped semiconductor is undoped GaAs (Page 7, Line 16).

Regarding Claim 9, Cahen et al. disclose a semiconductor device, wherein said conducting semiconductor layer is a layer of doped n-GaAs which is on top of a semi-insulating layer of (Al,Ga)As which is on top of another semi- insulating layer of GaAs (Page 8, Lines 12-30; Page 9, Lines 1-14; Fig 2A, 2B). They disclose a thin layer of a multifunctional organic sensing molecule adsorbed on the undoped GaAs surface (Page 9, Lines 11-12; Fig 2A,2B). Cahen does not disclose a layer of at least one single-stranded DNA probe.

Connolly discloses immobilization of single-stranded nucleic acid probes to a base plate of a semi-conductor element (Figures 1-2; Page 1, [0008]; Page 2, [0019], for example).

Regarding Claim 10, Cahen et al. disclose a semiconductor device, wherein said conducting semiconductor layer is a layer of doped n-(A1,Ga)As which is on top of an insulating layer of undoped GaAs which is on top of a semi- insulating layer of GaAs, on top of said conducting semiconductor doped n-(A1,Ga)As layer there is a semi-insulating undoped (Al,Ga)As layer on top of which there is an upper undoped GaAs semi-insulating layer (Page 8, Lines 12-30; Page 9, Lines 1-14; Fig 2A, 2B). They disclose a thin layer of a multifunctional organic sensing molecule adsorbed on the undoped GaAs surface (Page 9, Lines 11-12; Fig 2A,2B). Cahen does not disclose a layer of at least one single-stranded DNA probes.

Connolly discloses immobilization of single-stranded nucleic acid probes to a base plate of a semi-conductor element (Figures 1-2; Page 1, [0008]; Page 2, [0019], for example).

Regarding Claim 11, the semiconductor device disclosed by Cahen has been outlined in the previous paragraphs. Cahen does not disclose wherein said single-stranded DNA probes comprise a sequence complementary to a sequence of a target DNA or RNA. Connolly discloses immobilization of single-stranded nucleic acid probes to a base plate of a semi-conductor element (Figures 1-2; Page 1, [0008]; Page 2, [0019], for example).

Regarding Claims 12 and 13, the semiconductor device disclosed by Cahen has been outlined in the previous paragraphs. Cahen does not disclose wherein multiple single-stranded DNA probes comprise a sequence complementary to a mutation sequence of a gene responsible for a genetic disease or disorder.

Connolly discloses multiple nucleic acid probes that have a base sequence complementary to the entire or part of a target base sequence of a gene causing a genetic disease (Page 7, [0065], [0076], for example). They disclose employing a base plate having a grid with at least two types of nucleic probes immobilized thereon (Page 6, [0054], for example). They disclose examining a plurality of genes on the same base plate (Page 6, [0054], for example).

Regarding Claim 14, the semiconductor device disclosed by Cahen has been outlined in the previous paragraphs. Cahen et al. also disclose that the sensitivity of their semiconductor device does not depend linearly on its surface area and it is able to

use the same solid state structure with different adsorbed multifunctional organic sensing molecules, subsequently making it able to be constructed as a sensor of small semiconductor devices capable of processing a large variety of chemicals (Page 14, Lines 1-28). Cahen does not disclose each device carrying a different DNA probe.

Connolly discloses employing a base plate having a grid with at least two types of nucleic probes immobilized thereon (Page 6, [0054], for example). They disclose examining a plurality of genes on the same base plate (Page 6, [0054], for example).

Regarding Claim 15, the semiconductor device disclosed by Cahen has been outlined in the previous paragraphs. Cahen does not disclose a device of the sensor array carrying a DNA probe comprising a sequence complementary to a sequence of a target DNA or RNA.

Connolly discloses nucleic acid probes that have a base sequence complementary to the entire or part of a target base sequence (Figures 1-2; Page 1, [0008]; Page 2, [0019], for example).

Regarding Claim 16, the semiconductor device disclosed by Cahen has been outlined in the previous paragraphs. Cahen does not disclose a device of the sensor array carrying a DNA probe comprising a sequence complementary to a mutation sequence of a target gene responsible for a genetic disease or disorder and at least another of said devices in the array carries a control DNA probe comprising a sequence complementary to the sequence of the normal gene corresponding to said mutation.

Connolly discloses multiple nucleic acid probes that have a base sequence complementary to the entire or part of a target base sequence of a gene causing a

genetic disease (Page 7, [0065], [0076], for example). Connolly discloses employing a base plate having a grid with at least two types of nucleic probes immobilized thereon (Page 6, [0054], for example). They disclose examining a plurality of genes on the same base plate (Page 6, [0054], for example).

Regarding Claim 17, the semiconductor device disclosed by Cahen has been outlined in the previous paragraphs. Cahen does not disclose a method for the detection of a target DNA or RNA which comprises: exposing the single-stranded DNA probe of at least one semiconductor device to a sample containing the target DNA or RNA, under hybridization conditions; and monitoring either the current change resulting from the hybridization process when a constant electric potential is applied between the two conducting pads or measuring the change in the electric potential required to keep a constant current.

Connolly discloses immobilization of single-stranded nucleic acid probes to a base plate of a semi-conductor element (Figures 1-2; Page 1, [0008]; Page 2, [0019], for example). Connolly specifically discloses that a current between the two leads is indicative of the presence of the target nucleic acid (Page 9, [0088], for example).

Regarding Claims 18 and 19, the methods for DNA or RNA detection and semiconductor device disclosed by Cahen has been outlined in the previous paragraphs. Cahen does not disclose wherein said single-stranded DNA probes comprise a sequence complementary to a sequence of a target DNA or RNA.

Connolly discloses nucleic acid probes that have a base sequence complementary to the entire or part of a target base sequence (Figures 1-2; Page 1, [0008]; Page 2, [0019], for example).

Conclusion

No claims are allowed. No claims are free of the prior art.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christopher M. Babic whose telephone number is 571-272-8507. The examiner can normally be reached on Monday-Friday 7:00AM to 4:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gary Benzion can be reached on 571-272-0782. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

12/20/05

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12/27/05